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THE USE OF PAINT ON THE FARM.

BY

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF CHEMISTRY,
Washington, D. C., September 20, 1911.

SIR: I submit for your approval a manuscript prepared by Mr. P. H. Walker, chief of the contracts laboratory of this bureau, on the use of paint on the farm, which it is thought may serve a useful purpose by calling attention to the economic importance of painting farm buildings and equipment, and giving such nontechnical directions and discussion as may serve to assist the farmer in the purchase and use of painting materials. The composition of paints can not be discussed to any extent without involving much technical detail, nor is it thought that the farmer can often mix his own paints to any great advantage; for these reasons no attempt has been made to give many formulas. The information given will, it is thought, enable him to purchase the paints economically and apply them intelligently and to the best advantage.

Respectfully,

F. L. DUNLAP,
Acting Chief, Bureau of Chemistry.

Hon. JAMES WILSON,
Secretary of Agriculture.

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INTRODUCTION.

There is probably no one point more neglected by the average farmer than the judicious use of paint, not only on his house and outbuildings, but also on machinery and various agricultural implements. It is perhaps the rule rather than the exception in some sections to see houses and agricultural implements on the farm sadly in need of paint. The idea seems to be prevalent that paint is used solely for ornamental purposes, and its use is regarded as a luxury rather than a necessity. While paint does, of course, serve the purpose of improving the appearance of property, it is far more useful for protection than for ornament. A small amount of money and work expended in keeping a valuable piece of machinery properly painted will add greatly to the length of its life. The same may be said of buildings. Another useful object which is accomplished by painting is the improved sanitary conditions of buildings and outhouses. It is not proposed in this bulletin to give instructions for artistic painting, or even for doing the class of work which would be expected of a first-class master painter, for such work can not be expected of one engaged in another business. But any man can do an average job of painting, and can thereby not only improve the appearance of his place, but can add greatly to the durability of all articles painted. The cost of such work is small, the necessary equipment is not expensive, and with proper care will last a long time. An attempt will be made to give directions for the care of paint and of the necessary tools used in its application and for the proper selection of different paints for various purposes, their preparation and application, and their approximate cost.

Certain terms will be used frequently with a somewhat restricted meaning, and they are therefore defined as follows:

A paint is a mixture of a pigment with a vehicle and is intended to be spread in thin coats for protection or decoration or both.

A pigment is the fine, solid material used in the preparation of paint and is substantially insoluble in the vehicle.

The vehicle is the liquid portion of the paint.

Bearing in mind these definitions, it is seen that while varnish is used very much in the same manner as paint, it could not be properly

classified as a paint, because it does not contain any solid particles of pigment. On the other hand, whitewash, which is not ordinarily called a paint (largely because of its cheapness), would comply with this definition very well.

BRUSHES AND OTHER IMPLEMENTS.

The only absolutely necessary implements are brushes. Probably the most generally useful brush is a round one with bristles about 6 inches long. Oval brushes from 2 to 2½ inches wide are also very good for general use, and a great deal of painting is done with 4 or 5 inch flat brushes. Of these three types it is difficult to say which is the best, different painters having their own individual preferences. The advantage of a flat brush is that a greater amount of surface is covered at a stroke, with the disadvantage that the paint can not be as thoroughly rubbed in. On the whole, therefore, it is best to use a round brush. The 6-inch bristles are too long for proper working, and before being used a piece of cloth should be tied around the brush about 4 inches from the end of the bristles and 2 inches from the binding. As the bristles are worn off this sleeve or bridle, as it is called, may be pushed back, thus materially lengthening the life of the brush. For painting sashes and other small surfaces smaller brushes are necessary, the most satisfactory being the small oval brushes with a chiseled end. For varnishing, oval or flat brushes with somewhat shorter bristles are generally used. For the application of whitewash and calcimine a very much larger brush may be used, since these are applied lightly to the surface and are not rubbed in. A flat 8 or 9 inch whitewash brush may be used with practically as much ease as a smaller one.

In addition to the paint brushes, dusting brushes made of stiff bristles are useful for cleaning the surface before painting. For cleaning rusted metal surfaces, steel-wire brushes (2 or 3 inches wide and 6 inches long with wires about 3 inches long) are frequently necessary.

If ready-mixed paints are bought the cans may serve as buckets, but if the paint is mixed from the paste a strong tin bucket large enough to allow for stirring the paint will be necessary. Scraping knives and putty knives are necessary tools for the painter, and it is well to have one or two of each, but a very good scraper can be improvised from a piece of sheet iron, and an old kitchen knife may be ground to a square end and converted into a very serviceable putty knife. A paint strainer is useful, but two thicknesses of cheesecloth tied over the top of a bucket answers practically as well. Paint should be strained before using it.

CARE OF BRUSHES.

Brushes for applying oil paints must be well cleaned after using, though for keeping overnight it is generally sufficient to wrap them in several thicknesses of paper. Some painters keep their brushes overnight by putting them in water. If, however, the brush is not to be used for several days, the paint should be washed out of it. Turpentine is one of the most satisfactory materials for washing a brush, but it is expensive, and a brush can generally be washed as well with kerosene, which is much cheaper. After washing off the paint with kerosene the brush should be rinsed with gasoline or benzin, then thoroughly shaken and well washed with soap and warm water. As soon as this washing is complete the brush should be shaken thoroughly so as to throw as much water out of it as possible and hung up with the bristles down to dry; when dried the brush should be thoroughly protected from dust. If much painting is being done it is less trouble to keep the brushes in turpentine or kerosene. For this purpose hooks should be fastened on the inside of a pail with a close-fitting cover, the brushes being suspended either by holes in the handles or by loops of string, so that the brushes hang in the kerosene or turpentine in the bottom of the pail. The bristles should be submerged in the liquid, but should not touch the bottom of the pail. If kerosene is used for cleansing, it should be removed by shaking the brush and rinsing it in turpentine before using again with paint. Brushes used with whitewash or calcimine should simply be washed and not put in the same liquids in which the brushes used for oil paints are kept. If a brush has been used for shellac varnish it should be kept in alcohol or in the varnish itself. In general a varnish brush may be kept in the varnish in which it is used.

DRYING OF PAINTS.

Water paints such as whitewash and calcimine dry in the ordinary sense; that is, by evaporation of the liquid, which in the case of the two paints mentioned is water. The drying of oil paints, however, is quite different, and in order to understand this attention must be drawn to certain peculiarities of the so-called drying oils. Suppose four plates of glass are coated, one with a thin film of water, another with gasoline, another with a heavy mineral oil, and another with linseed oil, and all four plates are exposed to the air for several days. The water and gasoline will evaporate and leave the plates dry and practically in the condition in which they were before applying the liquid. The plate covered with the heavy mineral oil will be found to be greasy, while the plate covered with linseed oil

will also have a coating on it, but this coat will first become tacky and finally set to a hard, varnish-like film. If this experiment is tried with other vegetable oils, such as olive oil, it will be found that some of them behave very much like the mineral oils; that is, there is very slight tendency toward the formation of a coating. Other oils, such as corn and soy bean, will behave in a manner similar to the linseed oil; that is, there will be the formation of a more or less tacky mass, with perhaps the final formation of a varnish-like material. None of the other common oils, however, will form the varnish-like coating so rapidly, nor will the coating be so hard as in the case of linseed oil.

Oils which behave like linseed oil are called drying oils. It will be seen from this illustration, however, that the term "drying" as applied to oil is not similar to the drying which takes place on the exposure of a material wet with water to the dry air. The drying of a substance wet with water is really the removal of the water by evaporation. The drying of a drying oil is a change taking place in the liquid. This change is accompanied by an absorption of oxygen from the air, and the drying does not take place in the absence of oxygen. It is hindered by moisture and hastened by sunlight.

The formation of this varnish-like film by the so-called drying of linseed oil is an exceedingly important operation in the drying of oil paints. Certain substances, compounds of lead and manganese, if dissolved in the oil, hasten drying. Boiled oil which contains compounds of lead or manganese, or both, will dry more rapidly than raw linseed oil. Instead of using boiled oil, however, the drying of the oil in paints is generally hastened by the addition of liquids known as driers. These liquids are composed of compounds of lead and manganese generally thinned with either turpentine or benzin, and are known as japan or japan driers. As before stated, while the use of a drier is necessary in a great many paints, the amount used should be small. It is a rather astonishing fact that many driers, if used in small proportions, will very materially hasten the drying of the linseed oil; whereas if a large amount of drier is added, the drying of the oil is retarded. There is another objection to the use of a large amount of drier, and that is that the film produced is not so durable as one produced by raw linseed oil alone or by the use of a raw oil containing the proper amount of drier. There are a number of other oils which have the property of drying like linseed oil, but none of them is the equal of linseed oil for a paint vehicle.

Bearing in mind these facts, it is seen that an oil paint would consist of the pigment mixed with a drying oil, preferably linseed oil,

and generally with the addition of a drier. Some pigments, however, have the property of hastening the drying of linseed oil, and when they are used (red lead, for example) it is unnecessary to add any other drier. The varnish-like film left by linseed oil is for practical purposes insoluble in water. It is not, however, impervious to water. If a bright piece of iron covered with a coating of linseed oil, and afterwards thoroughly dried, is exposed to moisture it will be found that while the iron will not rust so fast as uncoated iron, the rusting will take place to a considerable extent. Other experiments can be performed which will demonstrate that moisture passes through this film with comparative ease. But, if an oil paint is employed—that is, a mixture of pigment and linseed oil—it will be found that the water does not penetrate through the film so rapidly as it does through the linseed-oil film alone. Also the paint film is more resistant to mechanical abrasion. While there is some difference of opinion among experts as to the amount of pigment which should be used in a paint, it is generally considered that the greater the amount of pigment the more resistant the paint film is, provided all the particles of pigment are thoroughly covered with the oil. It would appear, therefore, that a film of oil, while it may seem to be homogeneous even if examined under a high-power microscope, is really porous, and by mixture of the oil with the pigment the pores are more or less completely filled, thus making a more impervious film.

In addition to the linseed oil and drier, paints frequently contain volatile substances, such as turpentine and benzin. The addition of these is largely for the purpose of thinning the paint to a better working consistency, so that it can be spread in thin layers more easily. These volatile substances evaporate almost completely and do not remain behind in the dried film. The only substance remaining which binds the solid particles of the pigment together is the oil.

PREPARATION OF SURFACES FOR PAINTING.

All surfaces should be clean and as dry as possible before the application of an oil paint. Much new wood is very difficult to paint. The resins in such woods as yellow pine and spruce tend to destroy any paint that is laid over them. When possible, it is well to allow a new house to stand unpainted for at least six months or even a year after the woodwork has been completed. By this exposure to the weather the resins are brought to the surface and are either washed away or hardened, and the resulting wood surface is in much better condition for painting than is a new structure. An unpainted house, however, is an unsightly object, and it is often desired to paint a new house at once. Painters adopt several methods of treating new

wood; probably the one most universally used is to coat all knots and other places where resin appears with shellac varnish, a solution of gum shellac in alcohol. Another plan is to mix with the priming coat of paint a small amount of benzol (coal-tar naphtha), which is claimed by some excellent authorities on painting to dissolve the surface layer of resins and allow the paint pigment to penetrate into the fibers of the wood, preventing the final forcing of the resins to the surface. After applying the priming coat, all nail holes and cracks should be well filled with putty pressed in hard. Filling in with putty should not be attempted before the priming coat is applied, as it is not likely to stick as well.

In painting iron surfaces all rust and grease should be carefully removed, scraping the surface down to bright metal with wire brushes or sandpaper and finally dusting off all adhering particles.

Painting should be done in warm, dry weather. It is much better to select the summer time for painting than the winter. Not only does the paint not flow so well in cold weather, but the surfaces of the painted objects are more likely to be moist, and a little moisture underneath the paint film, either on wood or iron, is very apt to cause serious trouble.

PAINTING EXTERIOR WOODWORK.

All wood is more or less porous, and the natural result of applying a substance like paint to such a material is that the liquid portion sinks into the wood and leaves a large portion of the solid material on the surface. Also different parts of the wood will differ in porosity, and there will tend to be different amounts of paint left on different portions of the surface. In order to do a good job of painting it is practically always necessary to apply several coats to new wood. The first or priming coat is made thinner than the others, the amount of thinning depending upon the porosity of the wood. For ordinary pine, a paint of proper spreading consistency, when mixed with an equal volume of raw linseed oil, generally furnishes a good material for priming. With very porous wood, such as redwood, more oil may be added. The priming coat should be applied with as much care as any other and should be thoroughly brushed into the wood, the brushing being carefully done so that the paint is evenly distributed, with no tendency to run. It is the custom of many painters to add a great deal of drier and of turpentine to the priming coat, and to apply the other coats almost immediately after finishing the priming. This is not good practice. The paint for priming should consist of the pigment, linseed oil, and a minimum amount of drier, with no turpentine or benzin; and after

applying it at least a week and preferably longer should elapse before putting on the second coat.

Three coats at least are generally necessary to make a good piece of work. The effect of the priming coat, if properly applied, is to fill the pores of the wood and furnish a foundation on which to apply the subsequent coats. Owing to the different porosity of different parts of the surface, it is almost impossible to completely fill with one priming coat, and an attempt to get a good effect by applying the finishing coat immediately on top of the priming generally results in failure. A second coat will not penetrate to any very great extent into the wood. It should not, however, dry with a gloss, because a glossy surface does not furnish a good foundation for the next coat. In order to prevent the gloss, most painters add turpentine to the paint for the second coat; the amount used, however, should be small—to each gallon of paint about a half pint of turpentine in hot weather, or a pint in cold weather, is sufficient. The second coat, which of course should have been evenly spread and well rubbed in with the brush, should be allowed to dry somewhat longer than the priming coat. The third, or finishing coat should be one which will dry with a gloss, and for this purpose there should be no turpentine or thinner added to the paint at all. This method is one which is advocated by a large majority of authorities on the painting of wood, but is seldom carried out by painters, the tendency being to add excessive amounts of turpentine or benzin, unduly thinning the paint and making it possible to spread it in thin, even coats with less labor than would be required for the same thinness and evenness when paint of a proper consistency is used.

INTERIOR PAINTING.

For oil painting exposed to the weather (outside painting) it is very important that a durable paint be selected, because even the best painted surfaces in time are destroyed by outdoor exposure. Inside of a house, however, the conditions are radically different. The painted surface is exposed to neither the extreme heat of the summer sun nor to the action of rain and frost to anything like the extent that outdoor painting is. In fact, any paint will last for a very long time inside. The main point in selecting a paint for this work is to choose one which will cover well the article to be painted and which contains colors that are permanent. The actual protective coating may be assumed to last as long as there is any necessity for it. Very light tints or very brilliant colors are likely to fade, and white paints containing a large amount of oil tend to turn yellow in dark rooms. The pigment lithopone, which is not suitable for outside work, can be used with satisfaction for interior painting. Calcimines, the so-called

cold-water paints,[1] in which no oil or expensive lead or zinc pigments are used, and which are, therefore, very much cheaper than oil paints, last very well on the inside; in fact, some of the oldest paintings in existence are fresco paintings made practically of calcimine.

For interior work the same directions apply as to outside painting, but it is not so important to have the final coating contain such a large amount of oil as to give a glossy finish. A dull finish is preferred by many people, and since this paint is not to be exposed to severe weather conditions, a larger amount of thinner may be used than for outside work. Also, paint for inside work should dry faster than one for the outside, and a somewhat larger amount of japan drier is generally used.

PAINTING OF METAL.

Tin or other metal roofing, also galvanized iron such as gutters and rain spouts, are very difficult to paint, as often the paint does not stick well. This is probably due to a very thin film of grease left on such material from the process of manufacture, and before attempting to paint a tin roof it is best to scrub it perfectly clean with soap and water or with cloths moistened with benzin, and then thoroughly dry before applying the paint. Galvanized iron may be treated in the same way, but it is much better to let this material stand for some time exposed to the weather before painting. The metal portions of machinery are generally cast iron or steel; wrought iron is rarely used, though it is more durable than steel. Cast iron is not so liable to rust as steel, and also the pieces are frequently thicker than the steel portions of a machine. There is perhaps nothing that actually needs paint for protection as much as the steel and iron portions of machinery. Before painting such material the greatest care should be taken to get the surface perfectly clean. Do not apply paint over rust, but clean thoroughly down to the bare metal with scrapers or wire brushes, and finally with dry scrubbing brushes. It is a mistake to spare labor in preparing a metal surface for paint. All oil and grease should be scrupulously removed, and the metal surface should be absolutely clean and dry before painting. The paint should be well brushed on, carefully filling all cracks.

Two or three coats of any good paint may be used. The paint which is generally supposed to protect iron from rusting better than any other is red lead. This is expensive, however, and rather hard to apply. The color also is some objection, although this can be overcome by mixing some dark pigment with it. The addition of a small amount of lampblack improves the color and the working quality of red-lead paint. A paint made of basic chromate of lead

[1] See page 21 for recipes for making calcimine.

(so-called scarlet lead chromate, or American vermilion) is even better than red lead as a material for protecting iron. This also is very expensive, even more so than red lead, and while the protection is not so complete with the use of cheaper paints made of iron oxid pigments, on account of the fact that pieces of machinery are very likely to have the paint scratched and injured mechanically, it is perhaps best to use an iron oxid paint for most of such work, because of its cheapness. Any good oil paint will give valuable protection to iron if it is properly applied.

MIXING PAINTS.

Paints may be prepared either by mixing the dry pigments with oil and turpentine or benzin; or the paste pigments may be used. The latter are ground in a small amount of vehicle, generally linseed oil. The best pigments are exceedingly fine powders, and it is frequently a matter of considerable difficulty to mix such a powder uniformly with oil so as to have every particle in contact with the vehicle. On this account it is generally considered much easier to make up a paint from the paste pigments than from the dry, because the former have already been ground in a small amount of oil in a mill. When a can of paste pigment is opened all of it should be used immediately or it should be mixed with some oil and kept covered, since the paste is likely to harden and will then be ruined if exposed.

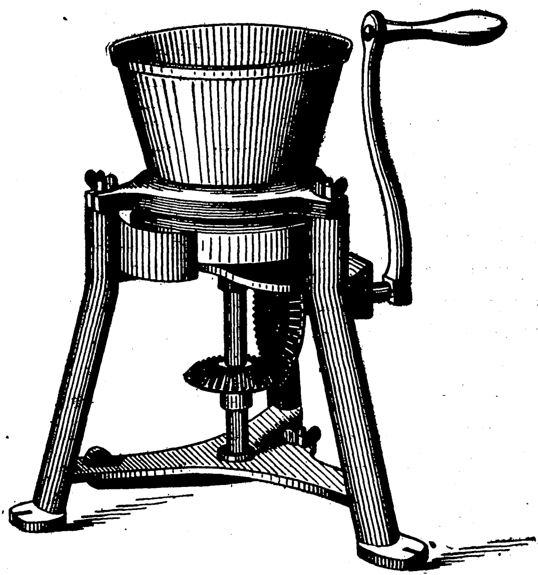

FIG. 1.—A hand-power paint mill.

A very satisfactory hand paint mill (fig. 1) can be bought for less than $10, and with such a mill the dry pigments may be mixed with oil and very satisfactory paints made directly. The claim is made, however, that many pigments require grinding under very heavy pressure to give the best results. Painters, therefore, generally prefer

the use of paste pigments rather than the dry for most of their paint mixing. Besides the method of making up paints from the pigments, either dry or in paste form, with the necessary vehicle, the use of ready-mixed paints is very common, and for a small job they have an advantage, for no paint can be made properly without a large amount of grinding or stirring, and this is rather heavy work. The user of mixed paints, however, should have some method of estimating what the material he buys is really worth.

COMPOSITION OF PAINTS AND THEIR COST.

GENERAL DISCUSSION.

It would probably not be denied by anyone that a better paint can be made in a well-equipped factory than by any individual at home or in a small shop. Many ready-mixed paints are of the very best quality, but many are of poor quality, made of cheap materials, and at the same time are sold with extravagant claims and for high prices. The number of different formulæ found on the market is enormous, and no attempt will be made to give a complete or even a representative list of them. An effort will be made, however, to give a few typical formulæ of paints and the methods of calculating the cost of making paints whose composition is known. A very good rule to follow in purchasing mixed paints is to buy nothing which does not bear the name of the manufacturer. If the manufacturer's name does not appear on the label this is very good presumptive evidence that he is not particularly proud of his product. Many State laws require that the composition of paints should also be stated on the labels, and a large number of the best manufacturers do this whether their products are sold in a State requiring such labeling or not.

The most expensive paints are generally white paints or very light tints. The reason for this is that there are comparatively few white pigments which have covering power, i. e., the property of hiding the surface of the material painted. Samples of dry white lead and of dry whiting look much alike. Both are white powders and a thin layer of each appears to be practically opaque. If, however, the two pigments are mixed in oil the whiting is quite transparent, while the white lead is opaque. All of the cheaper white pigments are more or less transparent in oil and are, therefore, deficient in covering power. White lead, zinc white, sublimed white lead, zinc lead, and lithopone are practically the only white pigments which have good covering power in oil. These pigments are all rather expensive, and as they are heavy it takes quite a large amount to make a paint.

Of the dark shades, there are a number of cheaper pigments which have very good covering power. It may be quite safely stated that

for a white paint that really covers, some one or more of the white pigments just enumerated must be used. For a dark brown, however, a good covering can be obtained with an iron oxid pigment, which is very much cheaper. Therefore, for such paints there is no reason for using an expensive lead or zinc pigment.

ESTIMATED COST OF WHITE PAINTS.

A vehicle for outside paint of the best quality will generally consist of from 90 to 95 per cent of linseed oil and from 10 to 5 per cent of japan drier. A good japan drier has about the same specific gravity as linseed oil, and each may be considered to weigh about 7¾ pounds to the gallon. Of course, the prices of all paint materials vary, but at the present time linseed oil sells for approximately 90 cents a gallon, and a good grade of japan can be bought for $1.60. In making up paints, the drier should be mixed with the larger portion of the oil before adding the pigment. Using the prices and weights just given for linseed oil and japan drier, the liquid portion of a paint will cost about 95 cents a gallon, or 12¼ cents a pound. White lead, both dry and in the form of paste, costs approximately 7 cents a pound, zinc white approximately 8 cents a pound, and the other white pigments which cover well will not differ very much from these two in price. A gallon of white lead paint will weigh from 21 to 22 pounds. Fourteen pounds of dry white lead and 7¼ pounds of vehicle will make a gallon of paint and at the prices quoted the cost would be about $1.87; 15 pounds of paste lead and 6¼ pounds of vehicle will make a gallon of paint, costing $1.82; 9½ pounds of white zinc and 5¾ pounds of the paint vehicle will make a gallon of zinc white paint costing about $1.46.

Of course, these prices are based on an assumed cost for the ingredients, and to make an exact estimate it would be necessary to know the exact prices of the different materials entering into the paint. Many painters insist that a paint composed entirely of white lead, linseed oil, and drier is the best. Others contend that a mixture of white lead and zinc white is the best, and still others say that a mixture of these pigments with the cheaper white pigments which have slight covering power makes a better paint than the expensive pigments alone. It is probably true that a mixture of lead and zinc is superior to either pigment by itself, and also that the addition of a small amount of so-called inert pigments (silica, whiting, barytes, china-clay, etc.) has no injurious effect on the paint and may even be beneficial. The addition of a large amount, however, of such pigments will give a paint deficient in covering power, and the addition should have the effect of cheapening the product. There is no reason why any mixed paint should cost per gallon more than a paint made

entirely of white lead, oil, and the necessary drier. By ascertaining the market price of white lead and linseed oil the buyer should be able to calculate the maximum price for a mixed paint.

Two samples of ready-mixed white paints which were bought at the same time, at practically the same price, will give an illustration of the difference in price of such materials. No. 3361, a white paint, weighed 12.4 pounds to the gallon. The total paint consisted of 63 per cent pigment and 37 per cent vehicle. The pigment contained 30 per cent zinc lead, 13 per cent white lead, 7 per cent whiting, and 50 per cent barium sulphate. Assuming the value of the zinc lead to be the same as that of the white lead, 43 per cent of the pigment was worth 7 cents a pound, and assuming the value of the whiting and barium sulphate to be 1 cent a pound, 57 per cent of the pigment was worth 1 cent a pound. The average price per pound of the pigment would, therefore, be 3.58 cents. A gallon of the paint weighs 12.4 pounds, of which 63 per cent, or 7.812 pounds, is pigment; this, at 3.58 cents a pound, would cost 28 cents. Thirty-seven per cent of vehicle in the gallon of paint will weigh 4.588 pounds. In this paint it consisted of linseed oil and a cheap benzin drier costing about 11 cents a pound, or 50 cents for the vehicle. The total cost of the materials in the paint, then, would be 78 cents per gallon.

Another paint, No. 3864, weighed 14.8 pounds per gallon and consisted of 58 per cent of pigment and 42 per cent of vehicle. The pigment was 55 per cent white lead and 45 per cent zinc white. If the price of these two pigments was 8 and 7 cents, respectively, the average price of the pigment in this paint would be 7.55 cents per pound. Since the gallon of paint weighed 14.8 pounds and contained 58 per cent of pigment, a gallon contained 8.584 pounds of pigment and 6.216 pounds of vehicle. The vehicle in this case was linseed oil and a good grade of turpentine drier. The pigment in this gallon of paint would be worth 65 cents (8.584×7.55) and the vehicle 76 cents (6.216×12.25). The total cost of the materials in this paint, therefore, would be $1.41.

These two paints, as before stated, were bought at the same time and at practically the same price. The prices paid would not be indicative of their value at the present day, since they were bought several years ago, when paint materials were considerably cheaper than they are now; but it is obvious that the margin of profit was very much greater on paint No. 3861 than on No. 3864.

ESTIMATED COST OF COLORED PAINTS.

Tinted paints, at least those of light tint, consist practically of white paint with the addition of a small amount of coloring matter. The coloring materials used in tinting are not uniform, and it is not

possible, therefore; to give exact directions for producing a particular shade, since the amount of color used will depend upon the individual characteristics of the particular lot on hand. In general, gray tints are made from white paints by the addition of a black pigment, such as lampblack or bone black, and sometimes a small amount of red or blue is used also. The total amount of coloring matter employed varies, but rarely amounts to as much as 5 per cent. Buff may be made by the addition of mixtures of ocher and umber; brown, by the addition of mixtures of black, red, and sometimes yellow. Yellow and cream may be made by the addition of ocher or chrome yellow; frequently for this purpose golden ocher is used, which is ordinary ocher brightened by the addition of a small amount of chrome yellow. Blue tints may be made by the addition of small amounts of Prussian blue. This is a powerful tinting pigment, and it is seldom that more than 1 per cent is required. With the white paints which contain no lead, ultramarine blue may be used instead of Prussian blue; but ultramarine blue should not be used with lead paints.

Besides the tinted white paints, bright colors are sometimes desired, especially green, for blinds, and reds for the trimmings of houses or for machinery. These paints seldom contain any large amount of the expensive lead and zinc white pigments, but consist of comparatively small quantities of coloring matter and large amounts of the cheap white pigments. For black paints there is practically only one coloring substance, namely, carbon, which, however, occurs commercially in a number of forms. The color of so-called drop or ivory black is carbon, obtained from charred bone; lampblack is carbon in the form of soot. The latter, although very pure, does not make a satisfactory black alone, the heavier forms of carbon, such as bone black or even ground charcoal, producing a better black.

In the following table is given the composition of several tinted paints, and also of bright red, bright green, and black. The composition of individual lots of paint of any of these tints or colors might vary considerably from that given, and the table is only illustrative of the materials from which these different kinds of paints may be made. An estimate of the cost of the raw materials entering into the different formulæ is also included. The total cost per gallon does not make any allowance for labor or for containers, but is based solely upon the cost of the raw materials, assuming that white lead and sublimed white lead cost 7 cents a pound, white zinc 8 cents, and the other white pigments, barium sulphate, china-clay, whiting, and asbestine, 1 cent a pound. The price of the coloring material is given separately for each paint. These prices for the raw materials are a fair approximation of the retail price at

the present time. In calculating the cost of the paints per gallon it is assumed that the vehicle in all cases is the same as that described on page 15 and it is valued at 12¼ cents a pound. An inspection of the table shows that there is comparatively little difference in the cost of the materials entering into these paints, with the exception of black paint, which is considerably cheaper than any of the others. The red paint is colored by an expensive color, para-red, costing 78 cents a pound; the rest of the pigment, however, is cheap, and it will be noticed that the paint weighs only 11.6 pounds per gallon, whereas some of the others weigh much more.

Composition and cost of tinted and colored paints.

Data.	Tints.						Colored paints.		
	Gray.	Buff.	Yellow.	Drab.	Blue.	Brown.	Red.	Green.	Black.
Percentage composition:									
Vehicle	43.4	43.0	45.0	41.0	43.0	49.0	57.0	34.0	65.0
White lead	....	....	13.0	....	....	12.0	....	....	....
Zinc white	21.0	21.0	25.0	21.0	22.0	24.0	2.0	....	....
Sublimed white lead	27.0	29.0	....	26.0	27.0	....	....	....	....
Barium sulphate	2.0	....	5.0	2.0	2.0	5.0	25.0	49.0	....
China-clay	5.0	....	....	4.0	4.0	....	....	....	....
Whiting	....	....	....	....	....	....	11.0	....	....
Ground slate	....	....	....	....	....	....	....	....	26.0
Asbestine	1.0	1.0	1.0	1.0	1.0	1.0	....	....	....
Color	.6	6.0	11.0	5.0	1.0	9.0	5.0	17.0	9.0
Total pigment	56.6	57.0	55.0	59.0	57.0	51.0	43.0	66.0	35.0
Nature of color	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Weight in pounds per gallon:									
Total	14.7	14.8	14.1	15.2	14.8	13.4	11.6	16.4	10.0
Pigment	8.32	8.44	7.76	8.97	8.44	6.83	4.99	10.82	3.50
Vehicle	6.38	6.36	6.34	6.23	6.36	6.57	6.61	5.58	6.50
Cost per pound, dollars:									
Color	0.05	0.04	0.05	0.05	0.30	0.05	0.78	0.19	0.10
Total pigment	.065	.069	.066	.065	.070	.066	.103	.056	.033
Cost per gallon, dollars:									
Pigment	.541	.582	.512	.583	.591	.451	.514	.606	.116
Vehicle	.782	.779	.777	.763	.779	.805	.810	.684	.796
Total	1.32	1.36	1.29	1.35	1.37	1.26	1.32	1.29	.91

[1] Bone black; tuscan red; ultramarine blue.
[2] Umber and ocher.
[3] Golden ocher.
[4] Ocher and bone black.
[5] Prussian blue.
[6] Bone black; venetian red; chrome yellow.
[7] Para-red.
[8] Five-sixths chrome yellow, one-sixth Prussian blue.
[9] Carbon.

For dark shades of brown or red there is probably nothing which is as cheap as the oxid of iron pigments. These vary very much in shade, giving both browns and dull reds. A pigment that gives a very satisfactory reddish brown and contains about 40 per cent of iron oxid makes a satisfactory paint containing approximately 56 per cent pigment and 44 per cent vehicle, the vehicle being very much the same as that used in a first-class white paint. Such a paint will weigh about 13.5 pounds to the gallon, which, therefore, will contain 7.56 pounds of pigment and 5.94 pounds of vehicle. This

pigment is cheap, generally costing not more than 1 or 1½ cents per pound. The pigment in a gallon of this paint, therefore, would cost approximately 10 cents, and the 5.94 pounds of vehicle about 73 cents, giving a cost of 83 cents for the gallon of paint.

An inspection of these figures shows that the expensive part of this paint is the vehicle and not the pigment. A paint of this character is a very good material to apply either to wood or iron. There are more expensive paints, however, frequently used on iron to protect it from rusting, the most popular being red lead and linseed oil. This material undoubtedly affords very good protection, but it is also expensive. A red-lead paint can not be made and kept as most other paints can. The red lead itself causes the oil to dry, and no additional drier is necessary. In fact, red lead should not be mixed until just before it is used. A paint made of 70 per cent of red lead and 30 per cent of linseed oil will weigh about 19.8 pounds to the gallon. A gallon of paint, therefore, will contain 13.86 pounds of red lead, which costs about 8 cents a pound, making the cost of the pigment in a gallon of this paint approximately $1.11. The 30 per cent of linseed oil will weigh 5.94 pounds, and a gallon of linseed oil 7.75 pounds, costing about 90 cents at the present time, or 11.5 cents a pound. The oil in the paint will cost then about 68 cents, and a gallon of red-lead paint would cost $1.79, as compared with 83 cents for a gallon of oxid of iron paint. These two paints will cover about the same area of clean iron, and while somewhat better service might be expected from the red-lead paint, it is more than twice as expensive as the iron-oxid products.

WHITEWASH.

Whitewash is the cheapest of all paints, and for certain purposes it is the best. Lime, which is the basis of whitewash, makes a very sanitary coating, and is probably to be preferred for cellars and the interior of stables and other outbuildings. The following directions for making whitewash are taken from "White Paints and Painting Materials," by W. G. Scott:

Ordinary whitewash: This is made by slaking about 10 pounds of quicklime with 2 gallons of water.

The lime is placed in a pail and the water poured over it, after which the pail is covered with an old piece of carpet or cloth and allowed to stand for about an hour. With an insufficient amount of water, the lime is "scorched" and not all converted into hydrate; on the other hand, too much water retards the slaking by lowering the heat.

"Scorched" lime is generally lumpy and transparent, hence the use of the proper amount of water for slaking and an after addition of water to bring it to a brush consistency.

Factory whitewash. (*Interiors*): For walls, ceilings, posts, etc.

(1) Sixty-two pounds (1 bushel) quicklime, slake with 15 gallons water. Keep barrel covered until steam ceases to rise. Stir occasionally to prevent scorching.

(2) Two and one-half pounds rye flour, beat up in ½ gallon of cold water, then add 2 gallons of boiling water.

(3) Two and one-half pounds common rock salt, dissolve in 2½ gallons of hot water.

Mix (2) and (3), then pour into (1) and stir until all is well mixed.

This is the whitewash used in the large implement factories and recommended by the insurance companies. The above formula gives a product of perfect brush consistency.

Weatherproof whitewash. (*Exteriors*): For buildings, fences, etc.

(1) Sixty-two pounds (1 bushel) quicklime, slake with 12 gallons of hot water.

(2) Two pounds common table salt, 1 pound sulphate of zinc, dissolved in 2 gallons of boiling water.

(3) Two gallons skimmed milk.

Pour (2) into (1), then add the milk (3) and mix thoroughly.

Lighthouse whitewash: (1) Sixty-two pounds (1 bushel) quicklime, slake with 12 gallons of hot water.

(2) Twelve pounds rock salt, dissolve in 6 gallons of boiling water.

(3) Six pounds Portland cement.

Pour (2) into (1) and then add (3).

NOTE.—Alum added to a lime whitewash prevents it rubbing off. An ounce to the gallon is sufficient.

Flour paste answers the same purpose, but needs zinc sulphate as a preservative.

Molasses renders the lime more soluble and causes it to penetrate the wood or plaster surface; a pint of molasses to 5 gallons of whitewash is sufficient.

Silicate of soda solution (about 35° Baumé) in the proportion of 1 to 10 of whitewash produces a fireproof cement.

A pound of cheap bar soap dissolved in a gallon of boiling water and added to about 5 gallons of thick whitewash will give it a gloss like oil paint.

An old receipt for whitewash, issued by the Lighthouse Board of the Treasury Department, said to be very good for outdoor exposure, is as follows:

Slake half a bushel of unslaked lime with boiling water, keeping it covered during the process. Strain it and add a peck of salt, dissolved in warm water; three pounds of ground rice put in boiling water and boiled to a thin paste; half a pound of powdered Spanish whiting and a pound of clear glue, dissolved in warm water; mix these well together and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace; and when used, put it on as hot as possible, with painters' or whitewash brushes.

The washes which contain milk, flour, or glue are not to be advised for use in damp, interior places, owing to danger of decomposition of the organic matter. For such locations it is better to use one of the formulæ containing none of these ingredients. Whitewash is applied with a broad whitewash brush and is spread lightly over the surface, no attempt being made to brush it in as is the case with an oil paint.

CALCIMINE.

Cold water paints or calcimine have as their basis whiting or carbonate of lime instead of caustic lime, as in whitewash. This material itself does not adhere, and it is necessary to use a binder of some kind, generally glue or casein. Scott also gives the following directions for making calcimine:

Ordinary white stock. (*Calcimine*): (1) Sixteen pounds dry Paris white (whiting) mixed until free of lumps, with 1 gallon boiling water.

(2) One-half pound white sizing glue; soak 4 hours in one-eighth gallon cold water. Dissolve on a water-bath (gluepot) and pour into (1).

The above recipe makes about 2 gallons of stock, weighing 12¾ pounds per gallon. It is of proper brush consistency and may be used at once, but is better after standing half an hour. Any tint may be given the white stock by stirring the desired dry color in a little water and adding sufficient liquid color to the base.

The following data in regard to the covering capacity and time of applying was obtained as an average of several years' work from shop records:

One gallon covers on plaster=270 square feet.

One gallon covers on brick=180 square feet.

One gallon covers on wood=225 square feet.

A man in 1 hour, using a 5-inch brush, will coat the following amount of surface:

Rough walls=22 square yards (198 sq. ft.).

Smooth walls=38 square yards (342 sq. ft.).

Brick walls=20 square yards (180 sq. ft.).

Flat surface (bench or floor) = 40 square yards.

Ceiling (with stepladder) = 25 square yards.

Damp-proof calcimine. (*White stock*): For plastered walls. (1) Sixteen pounds Paris white or extra gilder's whiting, 1 gallon boiling water.

(2) One-half pound white sizing glue, soak 4 hours in one-half gallon cold water, then dissolve on a water bath.

(3) One-fourth pound phosphate of soda, dissolve in one-eighth gallon boiling water.

Mix (3) with (1), then add (2).

If a thick white stock is wanted, use half a gallon of water with the 16 pounds of Paris white instead of one gallon. For tinting, use colors that are not affected by lime, namely, yellow ochers, sienna, umbers, Venetian red, para-red, maroon oxid, ultramarine blue, ultramarine green, chromium oxid, bone black, etc.

If lampblack is used for tinting, it must be stirred up in hot water containing a little soap or in cold water containing a little borax, the alkali overcoming the greasy nature of the lampblack.

PRECAUTIONS TO BE OBSERVED IN PAINTING.

Do not use any paints containing compounds of lead about stables or outbuildings where the fumes from decaying organic matter occur, since these gases are likely to darken the lead paints. Do not use with lead compounds any pigments which may liberate compounds

of sulphur. For example, ultramarine blue which contains sulphur in a form in which it may be set free is a beautiful and very permanent blue and may be used with zinc white, but should not be used with white lead or any other lead pigments. Prussian blue, on the contrary, does not contain sulphur and may be used with lead pigments.

Remember that turpentine and benzin are very inflammable, and especial precautions should be taken not to bring paint containing these substances near any light or open fire.

Many pigments are poisonous, and the workman should be particularly careful to remove all paint stains from the skin, and not under any circumstances allow any of it to get into his mouth. A man should not eat in the same clothes in which he has been painting, and before eating should not only change his clothes but wash all paint stains from his skin. It is not advisable to use turpentine or benzin in removing paint stains from the hands, but by oiling thoroughly with linseed oil, or, in fact, with any fatty oil, and then thoroughly washing with soap, the paint may be removed, provided it has not been allowed to dry too thoroughly on the hands.

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